



Materials Engineering Branch

TIP*



No. 077 Problems Associated with Nylon Usage on Spacecraft

Author(s): Frederick C. Gross

Contact: (301) 286-6882

Since the inception of the space program, Nylon, a polyamide, has been used for numerous applications which include fasteners, washers, nut inserts, standoffs, structural components, separator layers for thermal blankets, lacing cord, cable ties, cable clamps and button rivets. Nylon has been used extensively because of its desirable physical properties, low cost, availability, machinability and, to some extent, because of the absence of a readily available suitable substitute.

It has been known for several years that Nylon materials will adsorb a considerable amount of moisture (up to 3% by weight) when exposed to normal atmospheric conditions. The adsorbed moisture will come off if the Nylon is subjected to a vacuum and/or elevated temperature. However, as soon as the "dried out" Nylon is once again exposed to normal atmospheric conditions, it will readorb moisture because of its hygroscopic nature. It is a known fact that when the adsorbed moisture in the Nylon is released in a vacuum environment, it can have detrimental effects on experiments, especially to those with cold surfaces where the moisture can condense and freeze.

Data from space borne experiments have been compromised or rendered useless because of re-condensed moisture that off-gassed from materials such as Nylon. For example, the Filter Wedge Spectrometer, on Nimbus IV, was determined to have failed because of icing (condensed moisture) on the 176K HgCdTe detector surface¹.

There are a number of acceptable materials available that can be used as a substitute for Nylon. Some examples are polyester (Dacron), polytetrafluoroethylene or fluorinated ethylene propylene (Teflon), polyimides (Kapton and Vespel), polyvinylfluoride (Kynar) or acetals (Delrin). Nylon products should generally not be used for space flight applications unless there is not an acceptable alternate material available.

¹ DIRS#02273-I-2-TR-239-032-215, "Report of the Findings of the Radiation Cooler task Team", September 1970.